

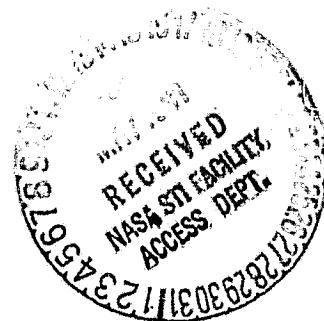
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LANDING IN THE FUTURE: BIOLOGICAL EXPERIMENTS
ON EARTH AND IN SPACE ORBIT

A. Pokrovskiy

Translation of "Desant v budushcheye;
Biologicheskiye eksperimenty na zemle
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16. Abstract This is a short article discussing the development of a earth biosatellite to duplicate the parameters of pressure, temperature, humidity and others as they exist in space on board "Kosmos-1129". It is written in the form of a press conference, with "quotes" from the Soviet technicians.					
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A. Pokrovskiy

"Kosmos-1129" had been circling the Earth for five days, yet here they were only preparing for the "launching" of its earth double. Was this a miscalculation in the synchronization of the experiment? On the contrary, it was a precisely tested calculation. In this time, telemetry had reported in detail on the operation of the biosatellite's systems, confirming data on pressure, temperature, humidity, and other internal parameters. Now they could be re-created in the analog. /3*

Just as in the Control Center, operators sit concentrating behind a control panel. Appearing on television screens are data obtained from orbit and... from the next room. From now on and to the end of the flight, these must correspond in the most minute detail. So that, even though we are in the Institute for Medico-Biological Problems, now this is a very real flight control center. We may say that it is namely here that control of future flights begins.

"Yes", says institute director Academician O. G. Gazenko, "we already have experience on continuous half-year life and work of a human being in space. Yes, we know that during

*Numbers in the margin indicate pagination in the foreign text.

flight a number of changes occur in the living organism, fortunately these are fully reversible upon return to ordinary conditions. But how is it at the cellular and molecular level? How does the hereditary apparatus react? As yet there are no exact answers here. However, if we want to have a firm foothold in space, and mankind is going in just this direction, we must find answers to the most complex questions. And here man is not always a convenient object for observation".

In Koltushakh near Leningrad, tourists are always shown the monument to a dog -- the trusty helper of the great Russian physiologist I. P. Pavlov in studying the higher nervous activity of man. The first living being to go into orbit was also a dog -- the famous Layka. And then Belka and Strelka became the first space travelers to successfully return to Earth. They lived out their lives quietly, leaving behind healthy offspring for specialists to observe.

And nevertheless, space research has its severe requirements on dimensions and weight. Therefore the fruit fly, *Drosophila*, is suitable to space biologists. The specifics of the multiplication and mutation of this fruit fly have been studied in detail by several generations of geneticists. And here to replace the dogs have come miniature white laboratory rats -- cute animals whose external appearance is not reminiscent of their grey brother rats.

And so the time has come to close the hatch on the

analog of the descending apparatus of "Kosmos-1129". No, it will not have to penetrate the thickness of the earth's atmosphere and descend from space heights. It is to duplicate the flight experiment in every detail, down to the noise of the engines and vibration of the apparatus on the active part of the route, but with the exception of purely cosmic factors -- primarily weightlessness and radiation. And this means that it will help scientists to clarify their effect in pure form.

"Careful, everything here is sterile!"

People in white lab coats with covers over their shoes carry cage cases with thirty laboratory rats past us. Seven more have been placed in a new cage, "Bios-vivaria", specially constructed for this flight.

"Another 37 animals of the same generation", adds the scientific director of the biological program, Candidate of Medical Sciences Ye. A. Il'in, "live as before in ordinary vivaria. This is one more control test which allows us to separate the effect of extraordinary conditions. After all, our messengers in space and on Earth will have to "work" along a rather complicated program. Individual rats will participate in experiments on "Stress", "Behavior", "Biorhythm", "Body composition". The essence of these experiments is already clear from their titles. I will only add that subsequent studies will be conducted down to the cell level."

Well, I would also like to tell you in great detail about the experiment "Ontogenesis" (individual development of an organism), which has never yet been conducted. This development

must start with the encounter of five females and two males placed in a "Bios-vivarium". It also determines the duration of the flight of "Kosmos-1129" -- it must land 2-3 days before the start of the births. Scientists assume that the pregnant females and the developing embryo will be more sensitive to the effect of factors of space flight, and primarily weightlessness.

However, we have no full assurance of the fact that everything will go as planned. Therefore, unique doubles for the rats are the eggs of Japanese quail. They are small in size, well studied, and also the possibility of quail becoming one of the links in the biological system of life provision in future space apparatus has not been ruled out. The program of the experiment proceeds from here. After completion of the flight, some of the eggs will be removed from the incubator for histological analysis, and the others will remain there until the chicks hatch (approximately 6 days after landing). These will be used for the proposed study of remote effects of space flight.

Cultures of mammal cells and higher plants found on the bio-satellite at a physiological temperature of 30 degrees Centigrade will help to augment the picture. Along this same line is the cleverly contrived experiment "Gravitational preference". Its essence is simple. Four tunnels made of transparent material are set up in a small centrifuge. In the

center of the apparatus, where even during rotation acceleration remains equal to zero, is a parent culture of fruit flies. The hatching flies, flying along the tunnels, may select one of three feeding dishes -- with 0.2, 0.6, and 1 force of earth's gravitation. Thus, we are able not only to understand the effect of weight on living organisms, but also to try to determine its evolutionary significance.

We have only to add that there is a garden aboard the biosatellite with corn, arabidopsis, cabbage, flax, and other plants, with on-going studies for automatically raising them from seeds. Also, the effect of heavy nuclei of galactic space radiation on biological objects located inside and outside the satellite is being studied, and methods of electrostatic protection are being developed.

The long-term expeditions on board "Salyut-6" are still fresh in our memories, whose successful completion was due to the input of reconnaissance experiments on "Kosmos-605, -690, -782, -936", which were launched starting in 1973. And now here is "Kosmos-1129". How does it differ from its predecessors?

"I have already spoken of the new experiments which are being conducted there", continues Ye. A. Il'in. "But repetition of tests is also important to science for accumulation of statistics, as well as their development and improvement. In this sense, research continues on the new biosatellite with consideration for previously obtained data, they proceed, so to speak, from that which has been achieved. I will cite only one example. It has been established long ago that in the course of space flight, calcium begins to be washed out

of the bone tissues of a living organism. But how this process goes on, to what limits -- this we still don't know. So, certain animals on board "Kosmos-1129" will be given only calcium-40 in their food in precisely dosed quantities. From this, the possibility arises for us to determine the balance of the process in which we are interested. But the main specific feature of the biosatellite is the complexity of its experiments. Let me remind you that on the first one, only the effect of weightlessness was studied. On the second -- the effect of radiation also. On the third we were able to create artificial gravity. Now we are conducting simultaneous physiological, biological, radio-biological, and radiation-physical experiments.

The complexity is also expressed in the make-up of the participants in the experiments. They were developed primarily by Soviet specialists utilizing Soviet rocket-space technology and scientific apparatus. However, scientific institutions of Bulgaria, Hungary, the German Democratic Republic, Poland, Rumania, Czechoslovakia, the USA, and France also made contributions.

The loading of the earth analog of "Kosmos-1129" lasted for several hours. Only by evening were all the devices, samples, plants, insects, and animals located in full correspondence with their cosmic counterparts. And we once again gathered in the same room with the Soviet specialists. No, this was not a continuation of the morning's press conference, where question - answer, question - answer clearly

followed each other. We could just feel that Oleg Georgiyevich Gazenko, a man who has led the Soviet space biological medicine program from its very inception, Boris Andreyevich Adamovich, Gazenko's assistant in the institute and doctor of technical sciences who by his own words has become "half biologist", and Yevgeniy Aleksandrovich Il'in, who grouped around himself an international collective of scientists not only because of his position, but also because of his excellent knowledge of foreign languages, all needed to think aloud, maybe even to ask themselves some questions after completion of the alternate work stage. That is how they conducted their conversation, unhurriedly, adding to one another. This is what they talked about that evening.

Of course, the flight of the new Soviet biosatellite is directly tied with the future solution of concrete problems in mastering the vastness of space. Of course, it will help in the search for answers to a number of fundamental problems of modern medicine and biology. But at the same time the scientists were worried by the fact that in the course of their work they had come face to face with the eternal secret of life. Conceived in the nourishing "bullion" of the Earth's ocean, life, in millions of years of evolution, had adapted to the conditions on our planet and had taken on earthly features. But is it possible only on Earth? Couldn't we allow the fact that we have not found signs of life on Mars because we did not know how to properly orient our devices to look for it? And would we recognize our co-brothers, upon

encountering visitors from far-away worlds?

For the time being, this theme is being discussed primarily on the pages of science fiction novels. But man's ever increasing penetration into space is gradually placing it into the series of vital scientific questions. And space travels themselves facilitate its solution, cutting off earthly influence.

This is still thinking aloud, if you will, hints of the distant future. But the processing of the data obtained on the "Kosmos-1129" biosatellite will help us to look into this future. Yesterday its descent module landed. In five days (the synchronization must be fully maintained) the hatch of its earth analog will open. And the comparison of earth and space experiments will begin...